

Appl. No. 10/606,118
Preliminary Amdt. dated May 5, 2004

Amendments to the Claims

Claim 1 (currently amended): A flashlight, comprising:

~~a high-power, directed~~ an LED configured to produce a divergent beam of light,
wherein the divergent beam of light exits the LED through a tip portion of the LED and
that is characterized by an optical directivity angle A extending from a vertex point, and
wherein additional light exits the tip portion of the LED in a direction extending outside
of the divergent beam of light; and

~~a lens having at least a portion that is a convergent portion, being~~ characterized by
a focal point, and a non-convergent portion configured such that light passing through the
non-convergent portion of the lens exits the lens at the same angle it enters the lens,
wherein the lens is sized and positioned such that substantially all of the directed light
from the LED passes through the convergent portion of the lens to emerge in a first beam
of parallel light, and wherein the LED is located such that its vertex point substantially
coincides with the lens' focal point; and

a parabolic reflector having a focal point, wherein the focal point of the parabolic
reflector coincides with the location of the tip portion of the LED so as to cause the
parabolic reflector to reflect at least some of the additional light into a second beam of
parallel light.

Claim 2 (canceled).

Claim 3 (canceled).

Claim 4 (canceled).

Claim 5 (original): The flashlight of claim 4 1, wherein the non-convergent portion of
the lens surrounds the convergent portion of the lens.

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Claim 6 (original): The flashlight of claim 1, and further comprising:

a switch;

one or more battery compartments configured to hold batteries, the battery compartments having contacts that are connected in a circuit that includes the LED and the switch such that the switch can close and open the circuit to energize and deenergize the LED when batteries are installed in the battery compartments; and

a housing configured to house the LED, the lens, the switch and the battery compartments.

Claim 7 (canceled).

Claim 8 (canceled).

Claim 9 (currently amended): An illuminator assembly for insertion into a flashlight having a lens, comprising:

~~a high-power, directed~~ an LED configured to produce a divergent beam of light, wherein the divergent beam of light exits the LED through a tip portion, wherein additional light exits the tip portion of the LED in a direction extending outside of the divergent beam of light, and wherein the divergent beam of light passes substantially through the lens' first portion to form a first parallel beam of light;

a parabolic reflector having a focal point, wherein the LED is physically held relative to the parabolic reflector in a position where the focal point of the parabolic reflector coincides with the location of the tip portion of the LED so as to cause the parabolic reflector to reflect at least some of the additional light into a second beam of parallel light that is parallel to the first parallel beam of light;

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a lens having a first portion that is convergent, being characterized by a focal point, wherein the LED is located such that its divergent-beam vertex point coincides with the lens' focal point, and wherein the lens has a second portion that passes light without changing its direction.

Claim 10 (currently amended): A flashlight, comprising:

an illuminator assembly including an LED, a printed circuit board, a flange, and a parabolic reflector;

a lens comprising a convergent portion, a nonconvergent portion, and a lens flange, wherein the convergent portion is characterized by a focal point; and

a housing conformingly receiving the illuminator assembly so as to contain the illuminator assembly within the housing;

wherein ~~components~~ associated circuitry is mounted on the printed circuit board, the associated circuitry configured to provide power to the LED;

wherein the LED is a high-power LED having a ~~filament~~ light emitting element, a parabolic micro-reflector and a transparent tip, the LED being mounted in the printed circuit board and configured to emit light from its light emitting element and produce by reflection from the parabolic micro-reflector a divergent beam of light that is characterized by an optical directivity angle extending from a vertex point, and also to produce additional light extending in a direction outside of the divergent beam of light and emanating from the tip of the LED;

wherein the parabolic reflector is connected to the printed circuit board such that the focal point of the parabolic reflector coincides with the transparent tip;

~~wherein the parabolic reflector has a flange;~~

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~~a housing conformingly receiving the illuminator assembly so as to contain the illuminator assembly within the housing.~~

wherein the flange is configured to engage the lens flange to position the LED so that the light emitting element is positioned at the focal point of the convergent portion and the divergent beam is centered on the focal center point of the convergent portion:

wherein substantially all of the divergent beam of light from the LED passes through the convergent lens to emerge in a first beam of parallel light; and

wherein the parabolic reflector reflects at least a portion of the additional light into a second beam of parallel light that is parallel to the first beam of parallel light and extending through the nonconvergent portion of the lens.

Claim 11 (currently amended): The flashlight of claim 9 10, and further comprising a body portion defining one or more battery compartments configured to receive one or more batteries, wherein:

the illuminator assembly is conformingly received by the body portion; and

the housing conformingly receiving the body portion so as to contain the body portion within the housing.

Claim 12 (canceled):

Claim 13 (canceled):

Claim 14 (canceled):

Claim 15 (new): A flashlight, comprising:

~~a directed~~ an LED configured to produce a divergent beam of light that is characterized by an optical directivity angle A extending from a vertex point; and

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a lens having at least a portion that is convergent, being characterized by a focal point, wherein the LED is located such that its vertex point coincides with the lens' focal point,

wherein the lens is sized and positioned such that substantially all of the divergent beam of light from the LED passes through the convergent lens to emerge in a first beam of parallel light,

wherein the portion of the lens that is convergent comprises a focal center point and is characterized by a convergence diameter D,

wherein the distance between the focal point and the focal center point defines a focal distance L,

and wherein the relationship between the convergence diameter D, the focal distance L, and the directivity angle A is described by the relationship $D \geq 2L \tan (A/2)$.

Claim 16 (new): The flashlight of claim 15, wherein the relationship between the convergence diameter D, the focal distance L, and the directivity angle A is described by the equation $D = 2 L \tan (A/2)$.

Claim 17 (new): The flashlight of claim 1, wherein:

the portion of the lens that is convergent comprises a focal center point and is characterized by a convergence diameter D,

wherein the distance between the focal point and the focal center point defines a focal distance L,

and wherein the relationship between the convergence diameter D, the focal distance L, and the directivity angle A is described by the relation $D \geq 2L \tan (A/2)$.

Claim 18 (new): The flashlight comprising:

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a high-power, directed LED configured to produce a divergent beam of light that is characterized by an optical directivity angle of about 20° extending from a vertex point; and

a lens having at least a portion that is convergent, being characterized by a focal point, wherein the LED is located such that its vertex point coincides with the lens' focal point,

and wherein the lens is sized and positioned such that substantially all of the divergent beam of light from the LED passes through the convergent lens to emerge in a first beam of parallel light.

Claim 19 (new): The flashlight of claim 1, wherein the directivity angle A is about 20° .

Claim 20 (new): A flashlight, comprising:

a high-power, directed LED configured to produce a divergent beam of light that is characterized by an optical directivity angle A extending from a vertex point;

a lens having at least a portion that is convergent portion, being characterized by a focal point, and a non-convergent portion configured such that light passing through the non-convergent portion of the lens exits the lens at the same angle it enters the lens, wherein the lens is sized and positioned such that substantially all of the divergent beam of light from the LED passes through the convergent lens to emerge in a first beam of parallel light, and wherein the LED is located such that its vertex point coincides with the lens' focal point;

a switch;

one or more battery compartments configured to hold batteries, the battery compartments having contacts that are connected in a circuit that includes the LED and

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the switch such that the switch can close and open the circuit to energize and deenergize the LED when batteries are installed in the battery compartments; and

a housing configured to house the LED, the lens, the switch and the battery compartments.